Mobile Operating Systems w/Android

Rick Rogers & Bruce Willins
Technology Solutions Group
AGENDA

- MSI Context
- Mobile Operating System Landscape
- Open Source Software & Distros
- Microsoft
- Linux
- Android
- Mobile Web
Motorola

On Jan. 4, 2011, Motorola, Inc. spun off its Mobile Devices and Home businesses, which became Motorola Mobility Holdings, Inc., and changed its name to Motorola Solutions, Inc.
MSI Customers / Perspective
A Diverse Application Landscape

GOVERNMENT
MANUFACTURING & FIELD MOBILITY
TRANSPORTATION & LOGISTICS
RETAIL & HOSPITALITY
ENERGY & UTILITIES
EDUCATION & HEALTHCARE
## Industry Expansion of the “Platforming” Paradigm

<table>
<thead>
<tr>
<th>INDUSTRY</th>
<th>MC5000</th>
<th>MC50000</th>
<th>MC5100</th>
<th>MC5900-G/KIS</th>
<th>MC5900-G RFID</th>
<th>MC5900-Safe/NI</th>
<th>MC5900-K</th>
<th>ES4400</th>
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<th>WT4000 Series</th>
<th>WT4090 VOW</th>
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MOTOROLA and the Stylized M Logo are registered in the US Patent and Trademark Office. All other product or service names are the property of their respective owners. © Motorola, Inc. 2010
Subject: RE: LiMo rises from the grave...sort of

Rick,

So now, BONDI is folded into WAC…WAC is aligned and conjoined with LIMO, meanwhile Maemo merges with Moblin to form Meego.. which is now merging with LIMO to form Tizen….Perfectly Clear To Me.

Regards,
Bruce
DEFINITION - THE SCOPE OF WHAT WE CALL AN “OS” HAS CHANGED SIGNIFICANTLY

Basic OS – Task Schedule, Resource Mgmt, Memory Mgmt, Hardware Abstraction, File Mgmt, IPC....

* William Stallings

e.g. Android
## A Fragmented Ecosystem of Development Environments, Languages, and Runtimes

<table>
<thead>
<tr>
<th>Common IDE</th>
<th>Programming Languages</th>
<th>Runtime</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Microsoft (WM / WEH)</strong></td>
<td>Visual C#</td>
<td>.NET Common Language Runtime</td>
</tr>
<tr>
<td></td>
<td>Visual Basic</td>
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<td>JScript .Net</td>
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<td>J#</td>
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<td>Visual C/C++, Win32 &amp; MFC APIs</td>
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<td><strong>Microsoft (W7, W8)</strong></td>
<td>Visual Studio</td>
<td>Silverlight/XAML</td>
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<td></td>
<td>XNA Game Studio</td>
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<td>Expression Blend</td>
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<td><strong>Apple</strong></td>
<td>X-Code</td>
<td>Objective-C</td>
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<td><strong>Android</strong></td>
<td>Eclipse</td>
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<td>IntelliJ IDEA</td>
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<td><strong>Blackberry RIM</strong></td>
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<td>Mobile Information Device profile</td>
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<td>Java Micro Edition</td>
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<td><strong>Symbian</strong></td>
<td>QT Creator</td>
<td>C++/QT</td>
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<td>NetBeans</td>
<td>Java</td>
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<td>Carbide</td>
<td>C++</td>
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</table>
Mobile Patent Suits
Compound A
Complicated Mobile Landscape
INDEMNIFICATION
PATENTS, COPYRIGHTS, TRADE SECRETS, AND TRADEMARKS

• “It is not possible today for a nontrivial program to be noninfringing on software patents granted in the U.S” – Bruce Perens, Co-founder OSI (open source Initiative)

• Microsoft covers patent, copyright, trade secret, and trademark disputes

• Commercial Linux Distros “May” Offer Indemnification
WHAT ARE THE ANALYSTS PROJECTING?

ANDROID GROWTH HAS BEEN DIFFICULT TO PREDICT

Table 1: Worldwide Mobile Communications Device Open OS Sales to End Users by OS (Thousands of Units)

<table>
<thead>
<tr>
<th>OS</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbian</td>
<td>111,577</td>
<td>80,030</td>
<td>32,666</td>
<td>461</td>
</tr>
<tr>
<td>Market Share (%)</td>
<td>37.6</td>
<td>19.2</td>
<td>5.2</td>
<td>0.1</td>
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<tr>
<td>Android</td>
<td>67,125</td>
<td>179,073</td>
<td>210,068</td>
<td>239,219</td>
</tr>
<tr>
<td>Market Share (%)</td>
<td>22.7</td>
<td>36.5</td>
<td>49.2</td>
<td>58.8</td>
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<tr>
<td>Research In Motion</td>
<td>47,452</td>
<td>62,600</td>
<td>79,335</td>
<td>122,864</td>
</tr>
<tr>
<td>Market Share (%)</td>
<td>10.0</td>
<td>12.4</td>
<td>12.6</td>
<td>11.1</td>
</tr>
<tr>
<td>iOS</td>
<td>46,998</td>
<td>90,569</td>
<td>118,648</td>
<td>189,924</td>
</tr>
<tr>
<td>Market Share (%)</td>
<td>15.7</td>
<td>19.4</td>
<td>18.9</td>
<td>17.2</td>
</tr>
<tr>
<td>Microsoft</td>
<td>12,378</td>
<td>26,346</td>
<td>68,156</td>
<td>215,998</td>
</tr>
<tr>
<td>Market Share (%)</td>
<td>4.2</td>
<td>5.6</td>
<td>10.8</td>
<td>19.5</td>
</tr>
<tr>
<td>Other Operating Systems</td>
<td>11,417</td>
<td>418,392,321,383,7</td>
<td>36,133,9</td>
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</tr>
<tr>
<td>Market Share (%)</td>
<td>3.8</td>
<td>3.9</td>
<td>3.4</td>
<td>3.3</td>
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<tr>
<td>Total Market</td>
<td>296,647,646,701,630,476,1104,098</td>
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</table>

Source: Gartner (April 2011)

http://www.gartner.com/it/page.jsp?id=1622614
“App Stores…The New Life Blood of A Platform”

By Jan 2009 Approximately 300M Smartphones Already In Service

Apple App Store – Jul 2008
Android Market – Oct 2008

Sept 2011 Apple App Store:
>476K Apps
>106K Publishers
>250K App Adds In 12 months

By EoY 2011 ~388M Android & IOS Devices In Service with ~1.18M Respective Store Apps

@ $50K Per App Development Development Costs:
~$59,050,000,000

(1) http://www.gartner.com/it/page.jsp?id=1529214
In 2011 The # of App Downloads Will Exceed World Population by 2.5x......17.8B (81% free)

In 2011 Revenues From Downloads/Advertising Will Exceed The 2010 GPD of 83 Nations.....$15.1B

From 2008 to 2014 More Than 185B App Downloads

In 2016 45B Downloads (analyst Ovum Applications)

(1) http://www.gartner.com/it/page.jsp?id=1529214
“Huge Cost of Platform Fragmentation”

In US 2008 ~ 2.2M Computer Software Jobs
~ 17M Software Developers Worldwide

Vision Mobile Developer Economics
- ~13 Different Platforms
- 5-15 Months To Master Each

Estimate Mobile App Developers | 300,000  
~ % Learning 2 Platforms | 40%  
Avg Time To Learn A Platform | 10 man months
1800 hrs  
Hrs Spent Learning 2nd Platform | 216,000,000 hrs  
Total Cost Of 2nd Platform ($50/Hr) | $ 10,800,000,000
WHOSE NOT WINNING THE APP RACE
EVOLUTION OF THE OS PLATFORM

- Security & Management of WM / RIM
- Web 2.0 RIA HTML5/JS Programming & Execution
- Flexibility, Openness, Innovation, Marketplace
- User Experience & Intuitive Nature of Apple
- Multi-Purposed CLD
- Hosted Svcs
Windows Embedded CE / “Windows Embedded Compact (WEC)”

- Modular/Configurable OS/Kernel – Approximately 700 Catalog Components
- Deterministic Real-time Multi-tasking
- Streamline for small memory footprint
- Support for Multiple Processors (x86, ARM, MIPS, SH4)
- Limited Source code available (to OEMs) for customization (& Maintenance Support)
- Scalable Cost (“Core License”, “Professional License”, “Motorola Custom”)
- Often Targeted For “Application Specific” Platforms
  Wearable Computers, Vehicle Mount Computers, Headless devices, Set-Top-Boxes, Automotive PCs……Kernel for WM
- Recent Release
  - CE 6.0 R3: RTM Sept 09
  - WEC 7: RTM Mar 2011 (ARM7, SMP Support)
Windows Mobile /
Windows Embedded Handheld (WEH)

- A Comprehensive Mobile Platform, Targeting PDA and Smartphones Class Devices
- Based on Windows CE OS
- Microsoft Chooses the components from CE catalog rather than the OEM (OEMs must include all standard components)
- All Windows Mobile devices have same Microsoft defined feature set
  - Microsoft requires Logo test to ensure compatibility
- Adds Productivity Apps and User Interface Shell, control panels
  - Outlook, Mobile Word, IE Mobile, etc.
- Adds Dialer and cellcore programming interface
  - CE 6 inherited Cellcore but not the dialer
Sample Features In WM, “Not In CE”

- “Platform”
- Logo Test Kit (LTK) Assures Uniformity
- New Skins & Icons (more Vista Like)
- **Outlook Mobile w/ EAS (Exchange ActiveSync) for Email, Calendar, Contacts, & Tasks**
- Exchange ActiveSync (EAS) policies
- Password enforcement
- Remote Wipe
- Windows Update for critical patches
- Mobile VPN client
- SCMDM client (Active Directory/Group Policy) support
- Phone API
- Consumer Features (MyPhone, Marketplace for Mobile, Widgets, Social Networking (e.g. Facebook Mobile), Games, etc…)
- Customizable Home and Start screens. Themes.
- Enhanced lock screen
- Finger friendly gesture supported UI.
- Optional; Voice Commander, VOIP application/SIP stack (residential focused)…
Windows Phone 7 (WP7)

- Consumer Focus – Zune + XBOX+ Social NW + Office
- New mobile OS on a separate branch of WinCE 7.0
- Existing WinForm Applications not compatible
- XAML / Silverlight / XNA based programming paradigm
- Limited enterprise specific features
- Initial HW “Chassis” specification is very restrictive
- UI modification prohibited
- Future “Chassis” specs discussed but not defined or committed yet
Windows Phone 7 Series Applicability for the Enterprise

**Chassis Requirements**
- Snapdragon ARMv7 Cortex
- Capacitive 3.5” Multi Touch
- HW Buttons Layout
- Screen Ruggedization

**Application Development**
- Silverlight & XNA
- Managed Code only
- Only MSFT Apps run in background
- Data Storage – Isolated Storage
- Push through Cloud – Azure

**Security Management**
- Applications require valid market place license
- Management via Azure / Market place

**Enterprise Applicability**
- Processor not compatible
- Capacitive screens not suitable for enterprise usage
- Keyboard requirements not flexible
- Screen requirements do not permit ruggedization
- No flexibility in selecting HW components

- No support for WinForms
- No backward compatibility with WinMo
- No 3rd party background apps
- No SQL Mobile support for offline apps
- Cloud services model not adopted by all enterprise customers

- Lacking Data, File & External Storage encryption
- Lacking MDM capabilities
- Missing Life Cycle Management
Windows 8

ARM & X86 Processor Support

SoC Support: TI, Nvidia, Qualcomm…tbd

Touch-centric interface (but still w/key support)

Phone7 Like “Tiled” UI

Always On / Always Connected with Low Power States
For free.

In Anthropological Terms – “Gift Culture” members compete for status by giving things away

Antithesis of Brooke’s Law (Mythical Man-month)
– adding manpower doesn’t always imply more productivity
OS/Platform Trends

Pre-1990’s
Device/Vendor Proprietary
- Custom Embedded RTOS
- E.g. PSOS, VRTX, MTOS…
- Primarily Kernel with low level services

Mid 1990’s - 2015
Extensible Vendor Proprietary
- Emergence of Java/JVM, .NET – Managed Code
- Published API’s
- OS => “Platforms” Targeting HH Devices
- Proprietary- Microsoft, Apple, “Symbian” (pre-2008) …

2005 – ∞
Open Source Hybrids
- 2007 – Linux Mobile (LiMo)
- 2007 - Open Handset Aliance (OHA)/Android
- 2008 - Symbian Goes Open – Symbian Foundation
- (2012 – Rumors BADA May Go Open Source)

2011-∞
“Mobile Web or Web OS”
- Web Programming Environment
- Renewed Fervor of Write Once Run Everywhere (cross-Platform)
- Web & Local Execution Models
- FLASH, Silverlight, AJAX, Chrome, Widgets, CSS HTML5, JS….

✓ Avoid Single Company Reliance & Self-Interests
✓ Foster Widespread Collaboration
Is Linux/Android A Potentially “Disruptive Technology”

**Figure 2: Testing for Attributes of Disruptive Innovation**

<table>
<thead>
<tr>
<th>Product/Service Attribute</th>
<th>Explanation of Advantage or Limitation</th>
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<tbody>
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<td>Lower Price</td>
<td>Price is usually significantly lower than existing solutions, and the cost structures for organizations leading the disruptive innovation are proportionally lower.</td>
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<tr>
<td>Greater Convenience/ Simplicity</td>
<td>Product or service is generally simpler to acquire, use, and maintain, or involves a simpler and more convenient process for doing business.</td>
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<tr>
<td>Comparatively Inferior</td>
<td>Appears inferior when compared to existing products or services (example: bandwidth of WiFi vs. 100BaseT Ethernet). At their outset, disruptive innovations do not meet the needs of mainstream customers in established markets, cloaking their potential threat in the future.</td>
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<tr>
<td>Unique Capability &amp; Value</td>
<td>Provides distinctly unique value, despite inferior capabilities to existing products or services (example: wireless/cellular phone service vs. traditional landline phone service).</td>
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<tr>
<td>Leverages a Lower-Cost Business Model</td>
<td>This attribute allows disruptive innovators to remain profitable while selling at price points that fall below the break-even point of incumbent market leaders. Over time, disruptive innovators can effectively profit by serving market leaders’ lowest margin customers.</td>
</tr>
<tr>
<td>Targets an Underserved or New Discrete Market or Market Segment</td>
<td>Unique capability and value do not directly address the core performance demands of customers for existing products and services. Value is associated directly with a new, initially smaller market segment that is beginning to grow (example: PDAs vs. laptops &amp; personal computers).</td>
</tr>
<tr>
<td>Pursuing a Path to Adequate Performance</td>
<td>A product or service becomes truly disruptive when it reaches the adequate performance threshold. At this point, the product/service meets the minimum requirements for a significant portion of customers in the established market.</td>
</tr>
</tbody>
</table>

“**The Innovator’s Dilemma**, Clayton Christensen
MOMENTUM IN OPEN SOURCE MOBILE SOLUTIONS

Figure 3: Total Number of Smartphone Shipments (m) Split by Open Source and Closed Source OS 2009-2014

Source: Juniper Research
“Free As In Freedom” - Not Price
“Copyleft—all rights reversed”

Inalienable Rights of “Free Software”

• Freedom to run the program, for any purpose.
• Freedom to modify the program to suit your needs. (i.e. access to source code)
• Freedom to redistribute copies, either gratis or for a fee.
• Freedom to distribute modified versions of the program, so that the community can benefit from your improvements.

Open Source Initiative (OSI) Offers Over 73 Copyleft Licensing Models

• Reciprocal: distributed changes must carry same license (e.g. GPL)
• Permissive (academic): “do whatever you want with the code”, including commercial licensing

(FOSS = “Free & Open Source Software”)
IBM & Cisco Move Web Server Software To Apache Open Source

Microsoft Now A Sponsor Of OSS Appache Software Foundation ($100k/yr)

Strategy – Move Tactical Software Components To Open Source
– Open Source Provides
  • Free Maintenance
  • Free Enhancements
– Benefits
  • Reduce Costs
  • Focus On Strategic Initiatives
Complexities of Protecting Intellectual Property In An Open Source

Issues

- Sometimes Difficult To Quarantine Protected Source From Open Source
- IHV & Silicon Providers Often Have IP Built Within Their Drivers
- Exposing Register Operations Can Compromise IP by Design Inference

IP Protecting Solutions

- Closed Driver Only (can still be built into Open System)
- Closed Driver & De-Featured Open Driver
Android
General OSS Model

- ASL 2.0 / “Apache 2.0”
- ASL 2.0 / “Apache 2.0”
- ASL 2.0: DVM
- GPL V2: BlueZ, GNU LibC
- GPL V2
What is A Distro?

Wikipedia: “a set of software components (i.e. open source components) assembled into a working whole and distributed to a user community”

Linux Distributions (“Distros”)

- Desktop/Laptop
  - ubuntu
  - fedora
  - debian
  - PCLinuxOS
  - FreeBSD

- Mobile
  - OHA
  - LiMo (LiPS)

>300 Active Distros

Hacktivation Energy

“Community” (e.g. “Totem/Xine”)

Employees

ISV’s

Community of Contributors

Open Source Foundations/Projects

ODM or IHV

System Integrator

“Sub” Distro

Software Components

*Bundled Solution Suite

Free/Fee/Hybrid Versions

Kernel

GNU Toolchain

IHV & Si Drivers

OSI Licensing

www.opensource.org

*Based on Linux Online, http://www.linux.org
Fragmentation
Nothing New To Linux
(OSS “take it and fork it”)

FRAGMENTATION – TWEETDECK
BETA RELEASE
36,427 PARTICIPANTS / OCT 2010

Android Phones
Droid Eris
HTC Dream
HTC Hero/T-Mobile G2 Touch
HTC Magic/Sapphire/Mytouch
HTC Tattoo
HTC Wildfire
Huawei Ideos/U8150
LG Ally/Aloha/VS740
LG GW620/Eve

Motorola Backflip/MB300
Motorola Cliq/Dext
Samsung Acclaim
Samsung Moment/M900
Samsung Spica/i5700
Samsung Transform
Sony Ericsson Xperia X10 mini
T-Mobile G1

Android OS Versions

Roxio Mobile Angry Birds For All Android
http://blog.tweetdeck.com/android-ecosystem
### What is Linux? …It Depends

<table>
<thead>
<tr>
<th>Very Small Embedded Platforms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer Set-Top-Boxes</td>
</tr>
<tr>
<td>Wearables</td>
</tr>
<tr>
<td>Consumer Mobiles</td>
</tr>
<tr>
<td>Rugged Mobiles</td>
</tr>
<tr>
<td>Tablets/UMPC</td>
</tr>
<tr>
<td>Laptop / Desktop</td>
</tr>
<tr>
<td>Retail POS</td>
</tr>
<tr>
<td>Servers</td>
</tr>
</tbody>
</table>

- Bell Labs 1969 Unix
A # of OS’s Are Based On The Linux Kernel

"Sadly, a kernel by itself gets you nowhere" – Linus Torvalds

- "Unix Influenced OS Written In 1991 By Linus Torvalds"
- Release 2.6.24 Is Over 8.5 Million Lines of Code
- Real-Time, Multi-tasking…
- Monolithic Kernel vs Micro-Kernel
- By Design New Major Release On 2-3 Month Cadence
- ~1000 active contributors/developers in 100 companies)
- No Fee: GNU GPL License As Open Source at www.linux.org
- Kernel Derivatives Common

<table>
<thead>
<tr>
<th>Multitasking Scheduler</th>
<th>Memory Manager</th>
<th>Virtual File System</th>
<th>Network Interface</th>
<th>Inter-Process Comm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drivers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mobile OS’s Leveraging Linux Kernel

- Android
- palm webOS
- MeeGo (Nokia Maemo & Intel Moblin)
- bada
- Samsung

*Unix Like
Linux Monolithic Kernel

- Multitasking Scheduler
- Memory Manager
- Virtual File System
- Network Interface
- Inter-Process Comm

Drivers

- No Need For Driver CD, WU…(similar to MS “In-Box”)
- New Drivers = New Kernel
- Guaranteed Driver Compatibility
- Open Code – No IP Protection
- Closed Code Driver – Cannot Have Any Open Source
  (driver code re-use is a benefit of Linux)
Linux Kernel Maintenance
Rapid Response A Perceived Value

<table>
<thead>
<tr>
<th>Kernel Version</th>
<th>Release Date</th>
<th>Days of Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.6.11</td>
<td>2005-03-02</td>
<td>69</td>
</tr>
<tr>
<td>2.6.12</td>
<td>2005-05-17</td>
<td>108</td>
</tr>
<tr>
<td>2.6.13</td>
<td>2005-08-28</td>
<td>73</td>
</tr>
<tr>
<td>2.6.14</td>
<td>2005-10-27</td>
<td>61</td>
</tr>
<tr>
<td>2.6.15</td>
<td>2006-01-02</td>
<td>68</td>
</tr>
<tr>
<td>2.6.16</td>
<td>2006-03-19</td>
<td>77</td>
</tr>
<tr>
<td>2.6.17</td>
<td>2006-06-17</td>
<td>91</td>
</tr>
<tr>
<td>2.6.18</td>
<td>2006-09-19</td>
<td>95</td>
</tr>
<tr>
<td>2.6.19</td>
<td>2006-11-29</td>
<td>72</td>
</tr>
<tr>
<td>2.6.20</td>
<td>2007-02-04</td>
<td>68</td>
</tr>
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<td>2.6.21</td>
<td>2007-04-21</td>
<td>81</td>
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<td>2.6.22</td>
<td>2007-07-08</td>
<td>75</td>
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<tr>
<td>2.6.23</td>
<td>2007-10-09</td>
<td>94</td>
</tr>
<tr>
<td>2.6.24</td>
<td>2008-01-24</td>
<td>108</td>
</tr>
</tbody>
</table>

Release Cadence By Design 2-3 Months (avg has been 2.7 months)

Frequent Releases Reduce Application Backporting

~1000 Contributors Input To Each Release

~10,000 Patches Per Recent Releases

Release From Linux Foundation – Consider Distro Delay If Applicable
Complete Development Environment
SDK, Open JDKs, Emulator

Choice of JDKs

Emulator For Windows, Linux, Or Mac Platforms (tool-chain plug-in)

Full SKD, Tutorials...

Getting Started with Android
To get started with Android, please read the following sect
Installing the SDK and Plugin
How to install the Android SDK and Eclipse plug-in.
Developing and Debugging
An introduction to developing and debugging Android IDEs.
Hello Android
Writing your first Android Application, the ever popular
Anatomy of an App
A guide to the structure and architecture of an Android that makes up an Android app.
Notepad Tutorial
This tutorial document will lead you through constructing, edit and delete notes, and covers many of the basic concept concepts.
Development Tools
The command line tools included with the SDK, what they do, and how to use them.
Application Model
A guide to Applications, Tasks, Processes, and Threads. An application is run by the system and presented to the user.
Application Life Cycle
The important life-cycle details for Applications and their component parts.

(Took Me ~3 Hours To Install Tools and Get “Hello World” Running On Emulator
• Google Acquired Android Inc in Aug 2005

• OHA
  • Formed in Nov 2007
  • 48+ Members: Handset, Mobile Operators, Chips, Software, Commercialization
  • G1 Handset Announced Oct 2008 (T-Mobile & HTC)

• **Android Developer Challenge** - $10M In Awards For Best Applications, 1787 Submissions

• **Licensing**
  • Linux Kernel (GPLv2 - “Reciprocating” License)
  • User Space (Apache Software License - ASLv2)
  • Android Development Tools (ADT) Eclipse Plugin (EPL1)

• **Android Applications** – Java & Execute Within A Dalvik VM

• **Profile**; 39 device manufacturers, 550K devices activated/day, 231 carriers, 123 countries,
WHAT’S IN IT FOR GOOGLE?
“SERVICES & SEARCH”

• More Users For Google Online Services

• Home Screen Google Search Box

• First Run Request For Google Account (brings in your contacts)

• e-mail, photo sharing, and social networking

• Dedicated G-Mail Application
Why Android?

Google Marketing $

“Zero Cost”

No Single Vendor/Supplier Bias/Dependency

Touch Friendly UI

Customizable UI for Branding

Open To Customization

Vibrant Marketplace

Carrier Independence

OSS Flexibility

Maturity of Linux Kernel
EXAMPLE OF GOOGLE/ANDROID CYCLE
E.G. MOTOROLA MOBILITY XOOM

Google selects / works closely (Joint Dev – JD) with Hardware vendor on development for major release

SDK Preview

Release of JD product to public / retail (e.g. Xoom Feb 24)

Release Final SDK, OK To Publish Apps

Release Source Code (e.g. HC 3.0 – still pending)

Honeycomb 3.0 Jan 26, 2011

Retail Product Release Feb 24

+ 0-3 Wks Typical (Feb 24)

Normally Shortly After Final SDK
Android Release Lag Times OS-To-Device

Consumer Feature Releases Should Not Drive Enterprise Churn

- Forgo First To Market For Increased Testing & Value Adds
- Reduce Unnecessary IT Administrative Release Burden
- Release Enterprise Critical Patches In Real-Time

10 Major/Minor Releases in 30 Months
Maturity & Rate of Releases Are Issues For Enterprise

<table>
<thead>
<tr>
<th>Year</th>
<th>Version</th>
<th>Release Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>1.0</td>
<td>Sept 2008</td>
</tr>
<tr>
<td>2009</td>
<td>1.1</td>
<td>Feb 2009</td>
</tr>
<tr>
<td></td>
<td>1.5</td>
<td>May 2009</td>
</tr>
<tr>
<td></td>
<td>1.6</td>
<td>Oct 2009</td>
</tr>
<tr>
<td>2009</td>
<td>2.0</td>
<td>Nov 2009</td>
</tr>
<tr>
<td></td>
<td>2.0.1</td>
<td>Dec 2009</td>
</tr>
<tr>
<td>2010</td>
<td>2.1</td>
<td>Jan 2010</td>
</tr>
<tr>
<td></td>
<td>2.2</td>
<td>May 2010</td>
</tr>
<tr>
<td></td>
<td>2.3</td>
<td>Dec 2010</td>
</tr>
<tr>
<td>2011</td>
<td>2.4</td>
<td>Apr 2011</td>
</tr>
<tr>
<td></td>
<td>3.0</td>
<td>Mar 2011</td>
</tr>
<tr>
<td></td>
<td>3.1</td>
<td>Summer 2011</td>
</tr>
</tbody>
</table>

- **Android 1.1 (Petit-Four):** released mid Feb '09, primarily bugfix release
- **Android 1.5 (Cupcake):** pre-release mid Dec, official release April
- **Android 1.6 (Donut):** pre-release June, official release mid Sep
- **Android 2.0 (Éclair):** released November 2009
- **Android 2.1 (Eclair):** January 2010
- **Android 2.2 (Froyo):** May 2010 EAS remote wipe, strong authentication...
- **Android 2.3 (Gingerbread):** Dec 2010
- **Android 3.0 (Honeycomb):** Feb 22 SDK release, Source Release TBD
- **Android 2.4 (“Gingerbread“-2):** Apr-Jul 2011?, **Android 3.1 (Ice Cream):** Summer 2011
Gingerbread 2.3

- Black background (for emissive displays)
- Quick App Shutdown (Home screen shortcut)
- “Extra” Large Screen Support
- Fade to center shutdown
- New You Tube Application
- **NFC Support (Reader)**
- Google Web-M/VP8 Video Format
- **Sensor Support (e.g. Gyroscope for 6DF)**
- New Audio Effects (reverb, equalizer…)
- **Support For Front-Facing Camera**
- Native SIP VoIP Support (with SIP account)
- More Spacing in Keyboard / Long Press For Numbers or punctuation / Pop-Ups, Improved Prediction, Slide Text Cursor Control
- **Multilanguage Keyboard Support**
- Downloads Manager (easy access to all downloads)
- Copy/Paste
- Pencil in Search
- Power Consumption Graph / Duty Cycle Charts
Honeycomb 3.0
First Tablet Release / Code Fork – Presumably Merging on Ice Cream Sandwich

• New UI (system bar bottom of screen – running apps…, action bar top of screen)

• HH Application Compatibility (manifest change)

• Full disk Encryption

• Stronger Password Support (1- expiration, 2- avoid duplication, 3-force complex)

• SMP Multi-Core Optimizations (even for single-threaded apps), i.e. DVM Now Multi-Core Optimized

• Bluetooth - API Support For A2DP ( stereo headset) & HSP Profiles

• Improved Keyboard (better targeting)

• Browser Update – JS access to multitouch

• DRM Framework
Jun 2011: “Report: Microsoft wants $15 per Android handset”
“ZDNet believes that the $15-per-Android-handset fee is little more than "sabre rattling" on Microsoft's part and that the company could be just fine settling closer to the "$7 range."
“Maeil Business Newspaper's sources say that Samsung is willing to pay Microsoft $10 per Android handset “

Jul 2011: “according to a CNET report”, Oracle “approaching all Google handset manufactures, asking them to pay $15 - $20 as licensing fees”
Fragmentation – Tweetdeck Beta Release
36,427 Participants / Oct 2010

Android OS Versions

Android Phones

Android TweetDeck Beta Users by OS Version

Android TweetDeck Beta Users by Phone

http://blog.tweetdeck.com/android-ecosystem
SO MANY MOBILE DEVICES.
YOU WANT TO CREATE AN APPLICATION ONCE THAT RUNS ON THEM ALL.
WITH RHOELEMENTS, YOU CAN.
All Roads Are Leading To HTML5 (/Webkit)

Microsoft launches contest to encourage HTML5 content creation without browser plug-ins

Jun 2011 “On over 500 million handsets to date” - VisionMobile
We’ve Been Here before?

WORA
Java 1.0
~1995

JEE (Enterprise)
JSE (Standard)
JME (aka. J2ME)

Apple Newton PDA
2000 – Compaq iPAQ
1997 – Palm Pilot

SmartPhone
Dual & Multicore SMP’s

'06 Intel Strong Arm SA-110

CPU 200 MHz
.35 micron
16M/16M Memory

6x
800x
62x-1000x
1.2GHz+
45nm
1GB / 16GB

Java 1.0
~1995

JME (aka. J2ME)
JSE (Standard)
JEE (Enterprise)
THE FOUNDATION IS COMING TOGETHER

Multicore Ghz+ Processors With Significantly Enhanced GPUs & Memory

Performance – Exponential Increase, ~3x < 1 yr

HTML 5 / Webkit (on >500M HH’s)

Increased Awareness Of The Need For Normalized Peripheral Support
Mobile Development Framework

- Single X-Platform IDE
- Local Execution Capable
- Native App Performance
- Local D-Base w/Synch
- “MVC” Model Support
- Simplified Back-Office Integration
- Leverage Web Constructs
- Web Disposition
- Universal Std Peripheral Access
- Universal X-Platform IDE

Leverage Web Constructs

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Leverage Web Constructs

Web Disposition

Local Execution Capable

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Local D-Base w/Synch

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Universal Std Peripheral Access

Single X-Platform IDE
CONCLUSIONS

1. Slow Convergence of Mobile OS’s – Increased “Enterprization” of Android
2. Accelerated OS Abstraction - Increased Standardization & Prolonged Coexistence of Both Web & Native Applications
3. Slow But Continued Standardization of Deep Device Peripheral Access
4. Growth of Cross-Platform MDF’s But Instantly Crowded (MCAPs, MEAPs, Hybrids…)
5. Confluence of Consumer & Enterprise Platforms With Continued Proliferation of Purpose Built Devices
MOTOROLA RHO ELEMENTS
DEVELOP LESS. RUN MORE.